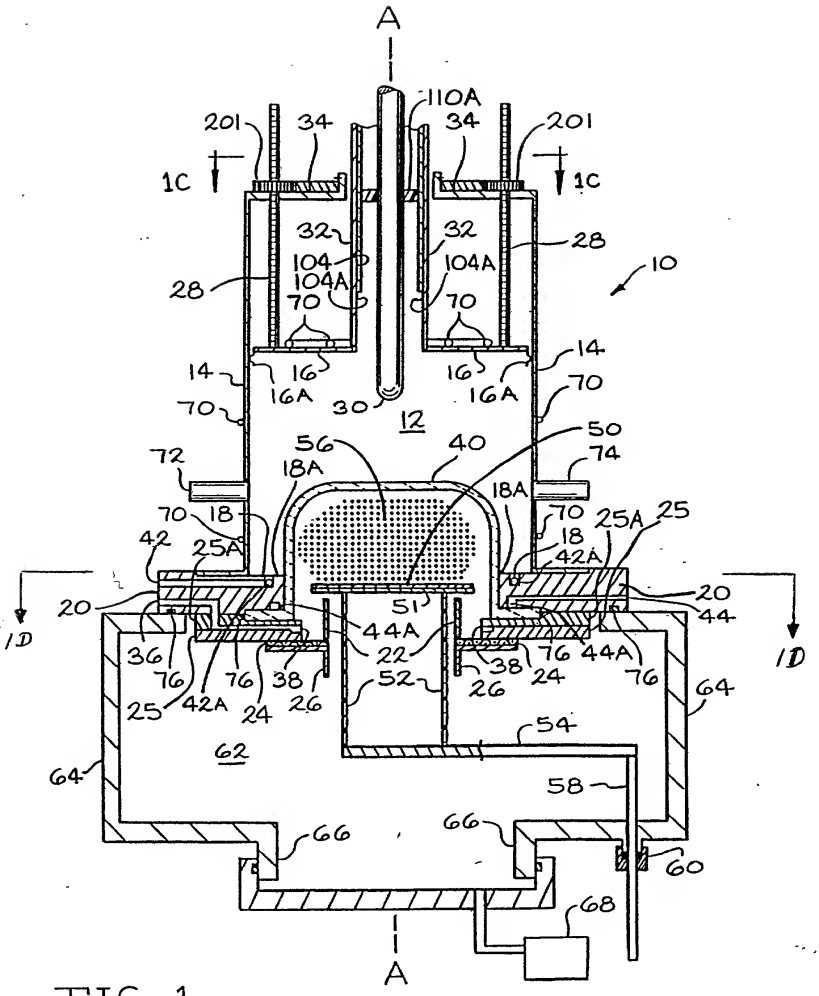

FIG. 1

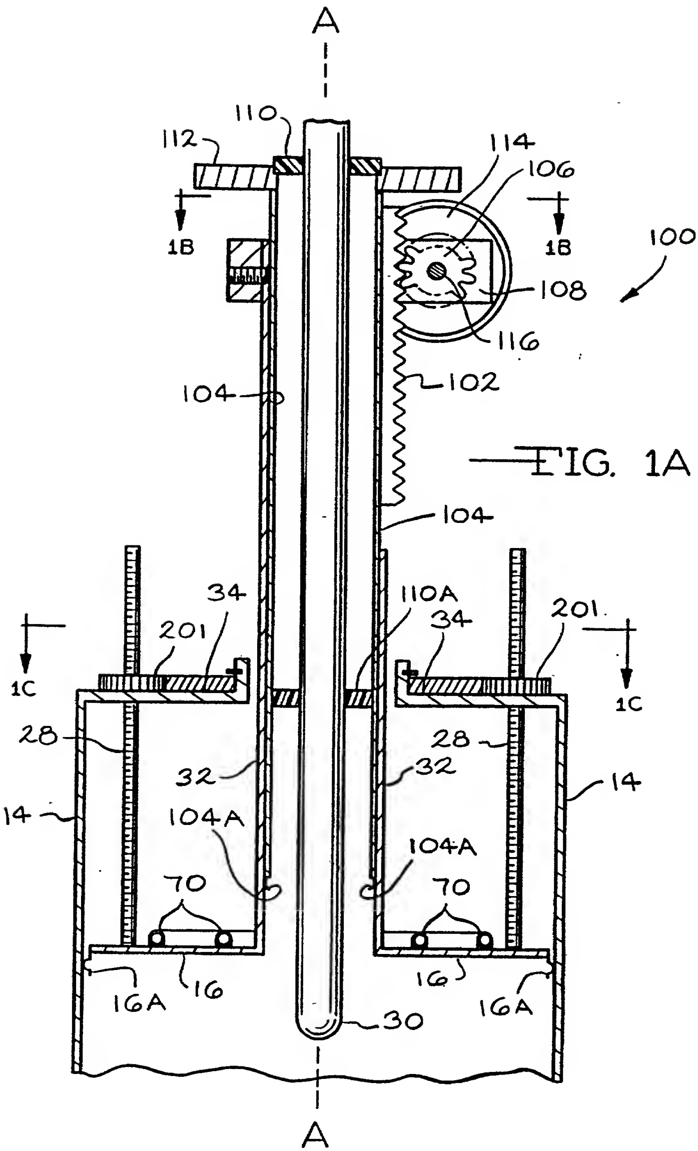
A
110
112
114
106
1B
1B
100
108
116
104
102
104
110A
34
34
201
201
1C
1C
28
28
32
32
14
14
104A
104A
70
70
16A
16
16
16A
30
A

FIG. 1A

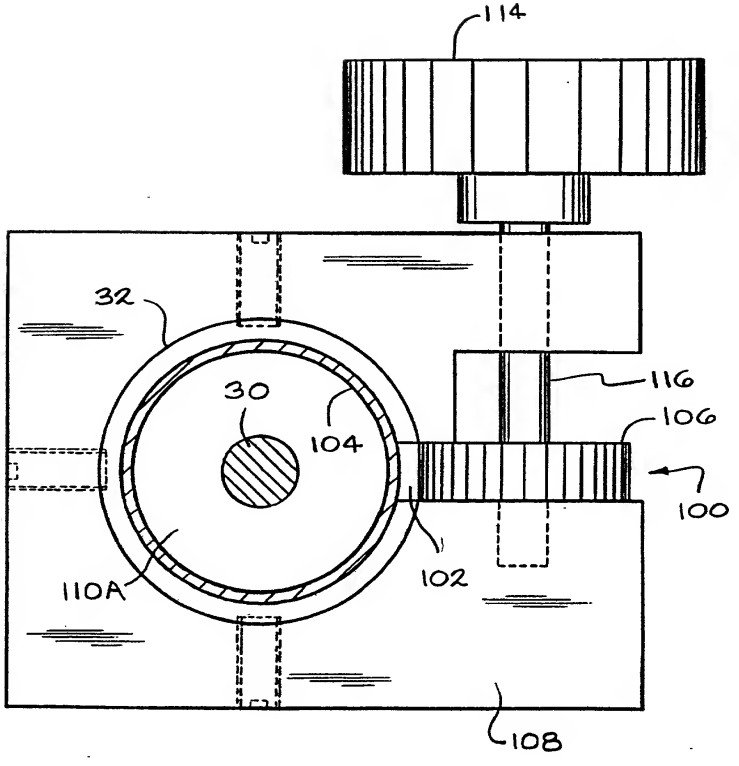

FIG. 1B

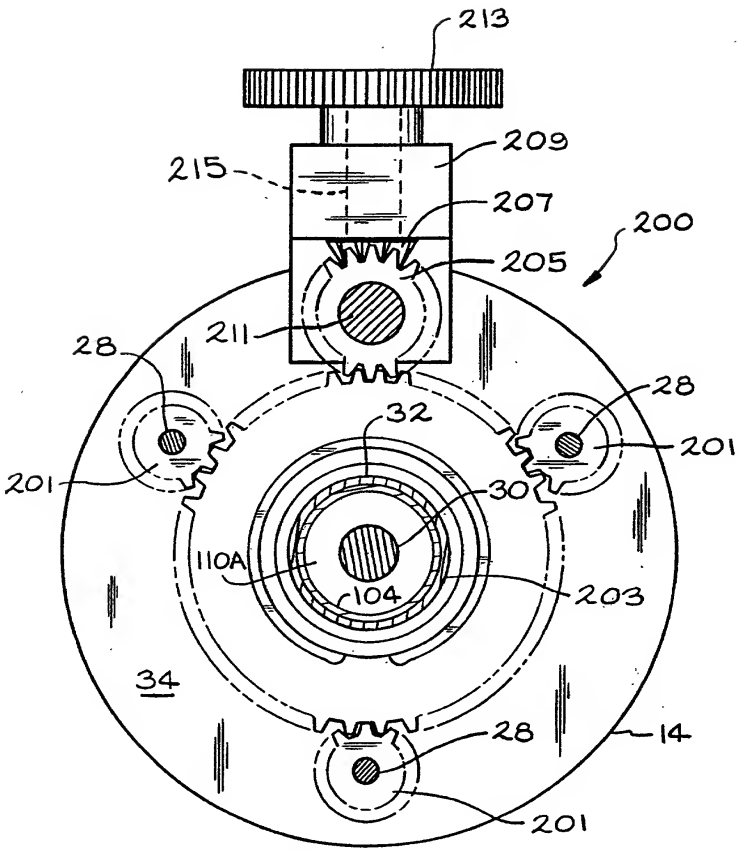

FIG. 1C

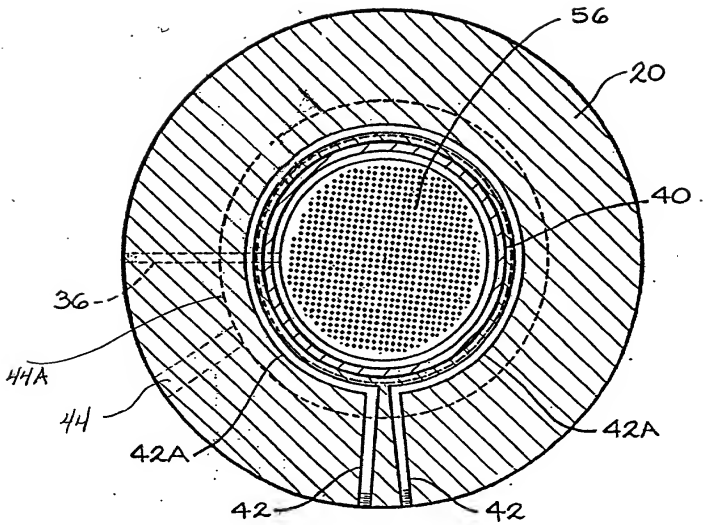

FIG. 1D

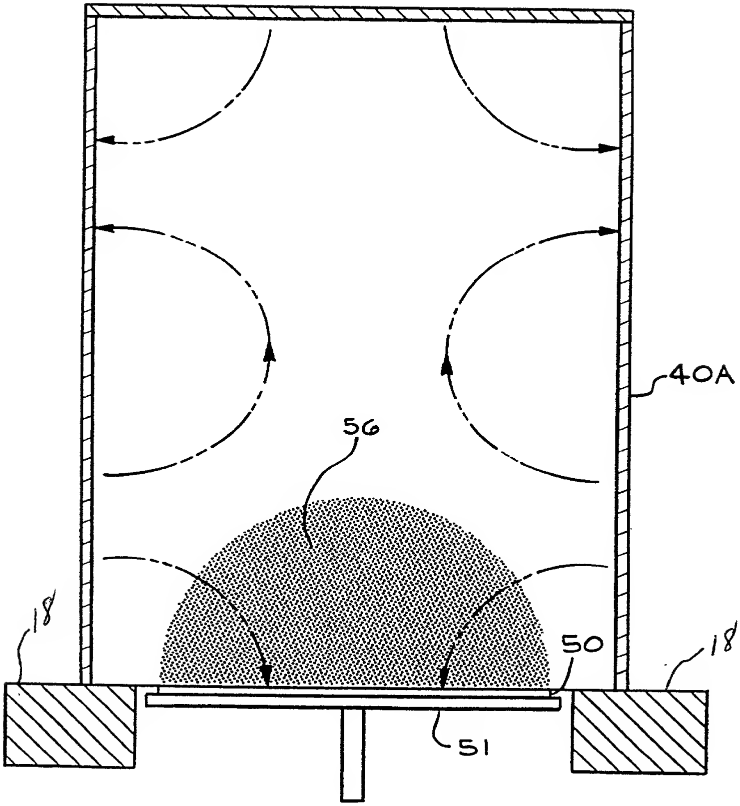

FIGURE 1E

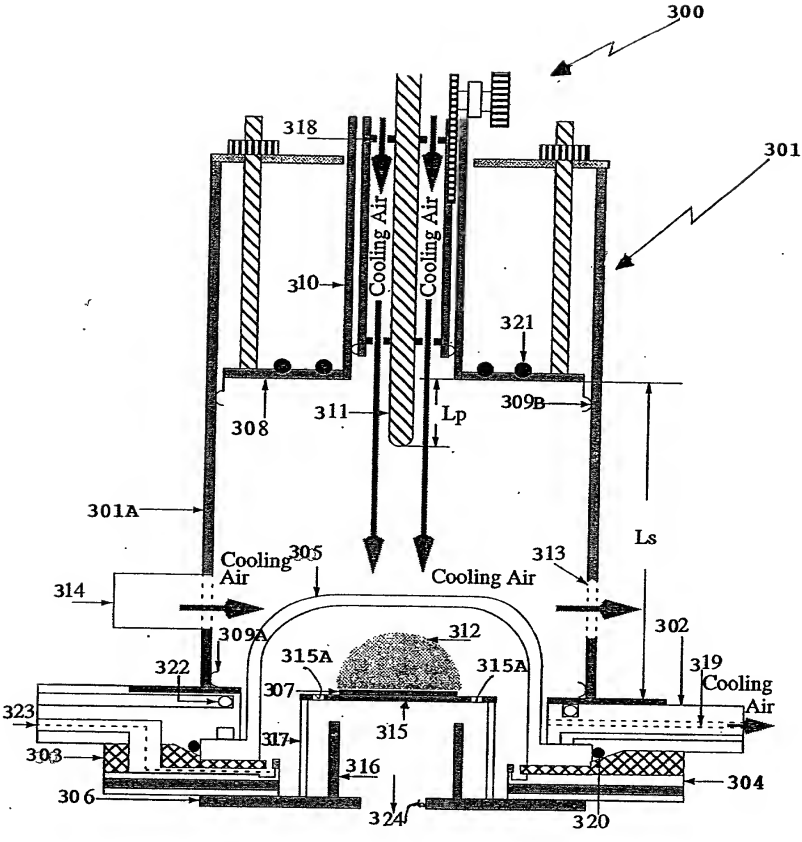
300
301
318
310
Cooling Air
Cooling Air
321
308
311
Lp
309B
301A
Cooling Air
305
Cooling Air
313
Ls
314
309A
312
302
315A
315A
319
Cooling Air
322
307
323
315
317
303
316
304
306
324
320

FIGURE 1F

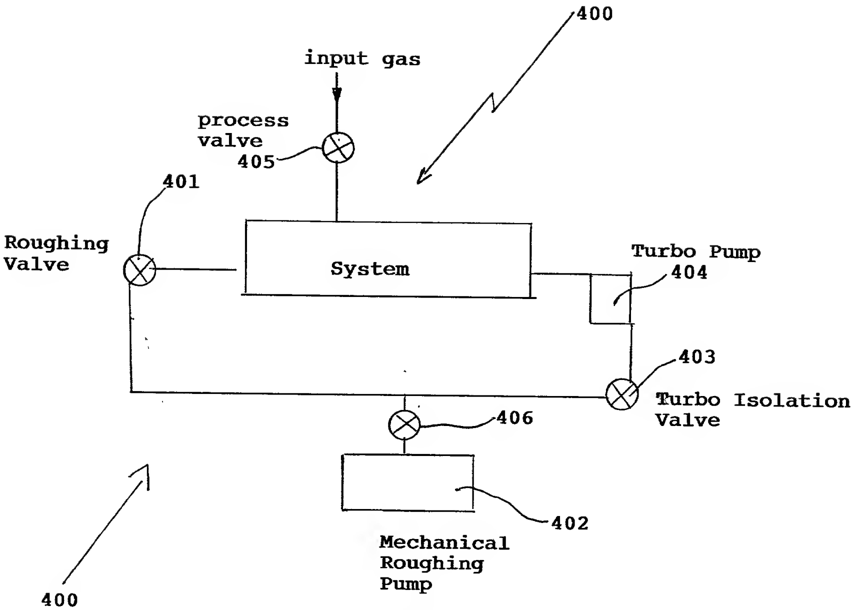
400
input gas
process
valve
405
401
Roughing
Valve
System
Turbo Pump
404
403
Turbo Isolation
Valve
406
402
Mechanical
Roughing
Pump
400

FIGURE 1G

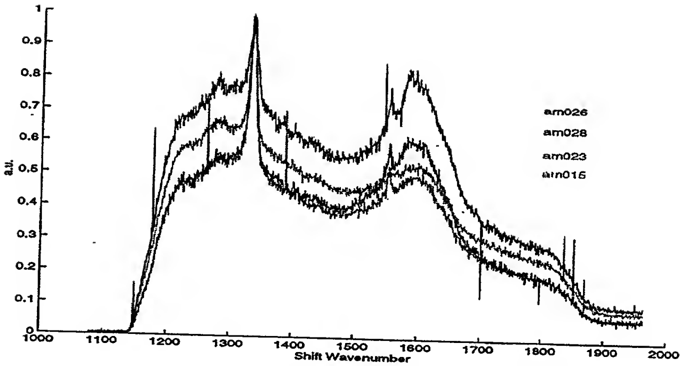

FIGURE 2

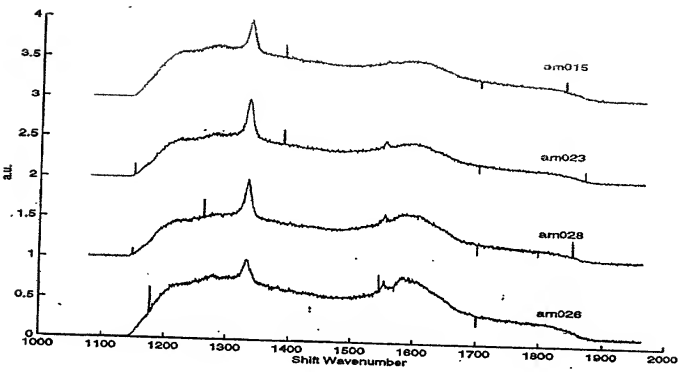

FIGURE 3

Pressure Investigation: $Ar/H_2/CH_4$=100/0/1 sccm

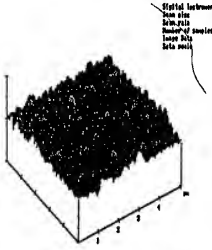

FIG.4A

60 Torr, Img. RMS=33.322 nm, growth=0.011 μm/hr

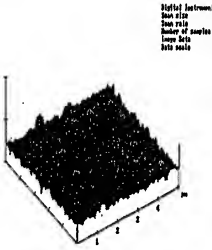

FIG. 4B

80 Torr, Img. RMS=22.696 nm, growth=0.018 μm/hr

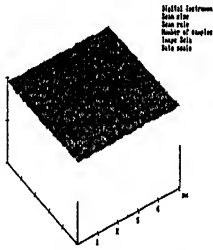

FIG.4C

100 Torr, Img. RMS=19.151 nm, growth=0.051 μm/hr

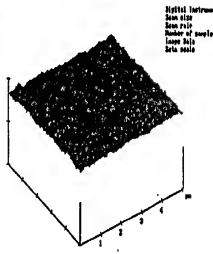

FIG.4D

120 Torr, Img. RMS=10.859 nm, growth=0.129 μm/hr

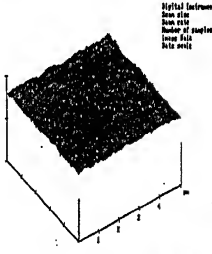

FIG.4E

140 Torr, Img. RMS=13.584 nm, growth=0.231 μm/hr

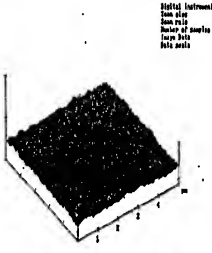

FIG.4F

160 Torr, Img. RMS=13.462 nm, growth=0.311 μm/hr

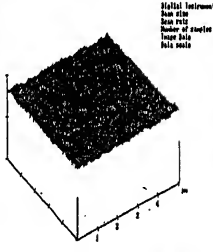

FIG.4G

180 Torr, Img. RMS=16.782 nm, growth=0.296 μm/hr

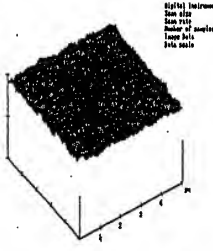

FIG.4H

200 Torr, Img. RMS=18.371 nm, growth=0.331 μm/hr

Pressure Investigation: $Ar/H_2/CH_4$=100/4/1 sccm

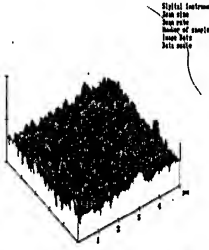

FIG. 5A

60 Torr, Img. RMS=40.538 nm, growth=0.014 μm/hr

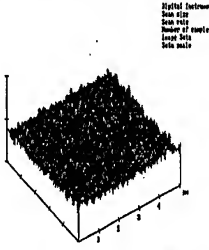

FIG. 5B

80 Torr, Img. RMS=16.363 nm, growth=0.055 μm/hr

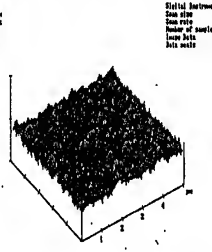

FIG. 5C

100 Torr, Img. RMS=19.250 nm, growth=0.118 μm/hr

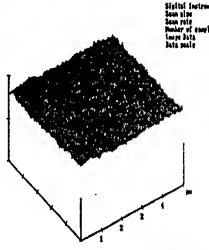

FIG. 5D

120 Torr, Img. RMS=24.332 nm, growth=0.237 μm/hr

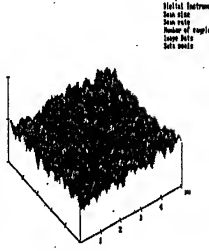

FIG. 5E

140 Torr, Img. RMS=24.942 nm, growth=0.400 μm/hr

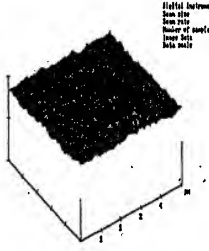

FIG. 5F

160 Torr, Img. RMS=31.763 nm, growth=0.494 μm/hr

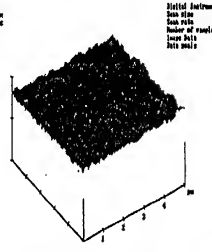

FIG. 5G

180 Torr, Img. RMS=33.015 nm, growth=0.614 μm/hr

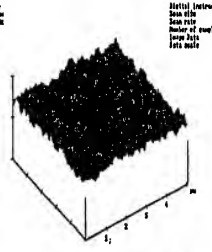

FIG. 5H

200 Torr, Img. RMS=31.661 nm, growth=0.792 μm/hr

H_2 Concentration Variation: P=120Torr

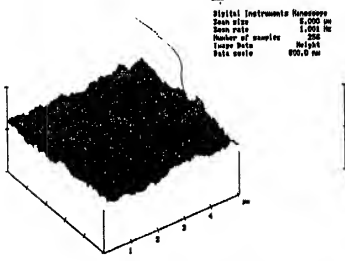

FIG.6A

$Ar/H_2/CH_4$=100/10 /1, Img. RMS=40.961 nm, growth=0.337 μm/hr

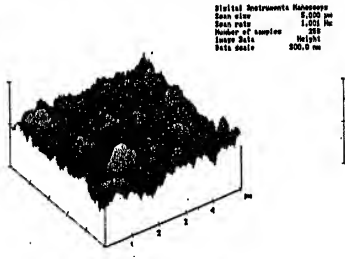

FIG.6B

$Ar/H_2/CH_4$=100/8/1, Img. RMS=31.818 nm, growth=0.328 μm/hr

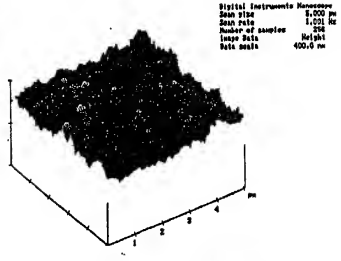

FIG.6C

$Ar/H_2/CH_4$=100/6/1, Img. RMS=30.316 nm, growth=0.283 μm/hr

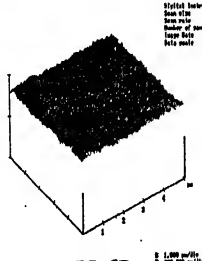

FIG.6D

$Ar/H_2/CH_4$=100/4/1, Img. RMS=24.332 nm, growth=0.237 μm/hr

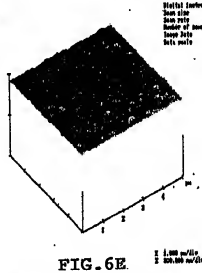

FIG.6E

$Ar/H_2/CH_4$=100/2/1, Img. RMS=16.208 nm, growth=0.172 μm/hr

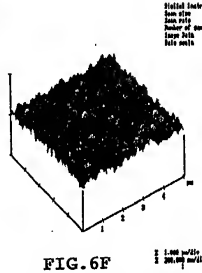

FIG.6F

$Ar/H_2/CH_4$=100/1/1, Img. RMS=12.787 nm, growth=0.148 μm/hr

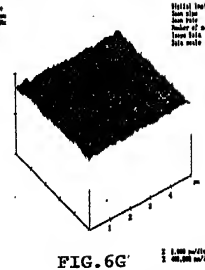

FIG.6G

$Ar/H_2/CH_4$=100/0/1, Img.RMS=10.859 nm, growth=0.129μm/hr

N_2 Impurity Study: P=120Torr, $Ar/H_2/CH_4$=100/4/1 sccm

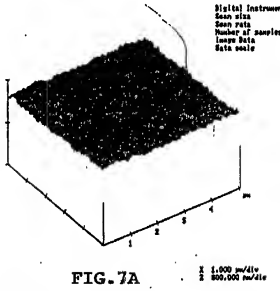

FIG.7A

5ppm N, Img. RMS=24.332 nm, growth=0.237 μm/hr

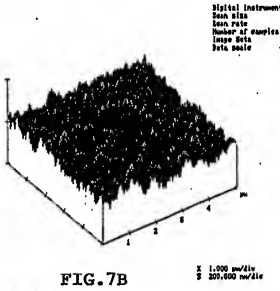

FIG.7B

300ppm N, Img. RMS=20.447 nm, growth=0.211 μm/hr

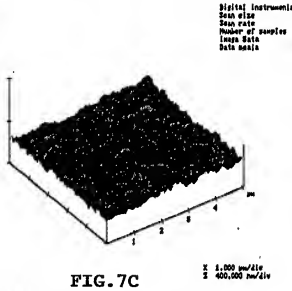

FIG.7C

800ppm N, Img. RMS=20.808 nm, growth=0.187 μm/hr

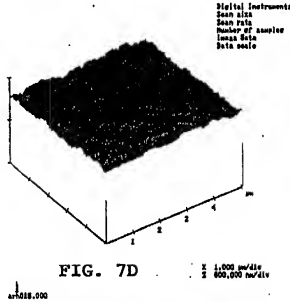

FIG. 7D

1500ppm N, Img. RMS=23.323 nm, growth=0.164 μm/hr

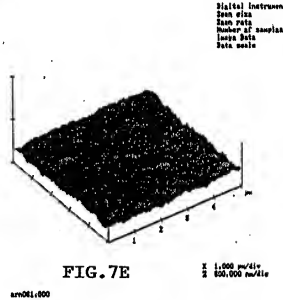

FIG.7E

2000ppm N, Img. RMS=20.825 nm, growth=0.160 μm/hr

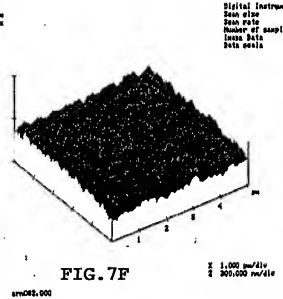

FIG.7F

2500ppm N, Img. RMS=17.706 nm, growth=0.147 μm/hr

$Ar/H_2/CH_4$ =100/0/1 sccm

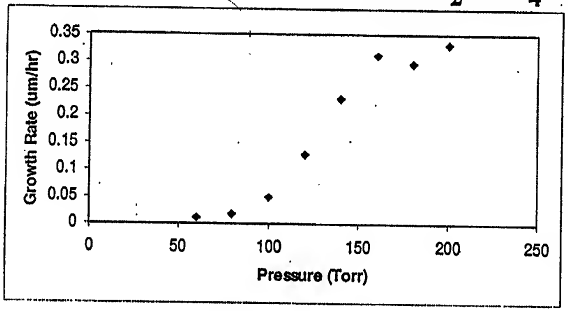

FIGURE 8

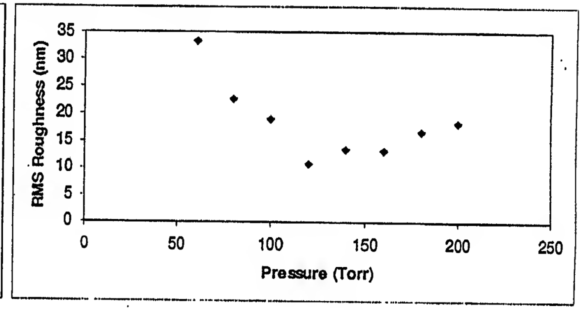

FIGURE 8A

$Ar/H_2/CH_4$ =100/4/1 sccm

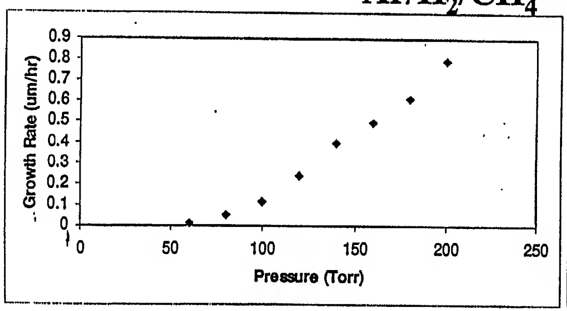

FIGURE 9

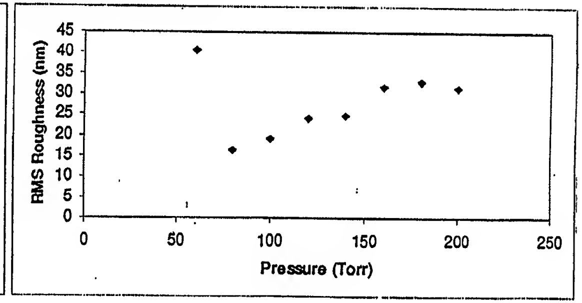

FIGURE 9A

H_2 Concentration: 120 Torr

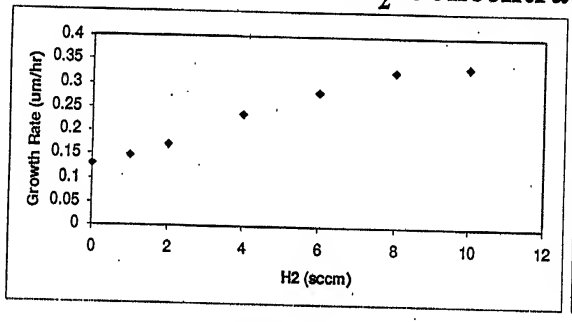

FIGURE 10

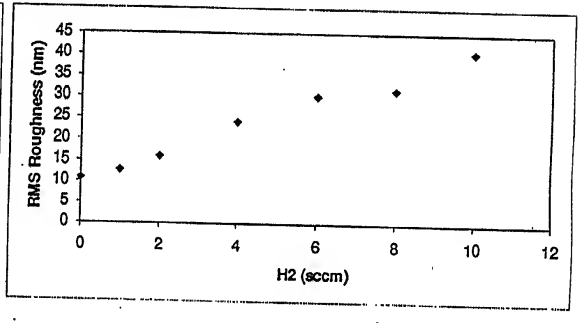

FIGURE 10A

N_2 Impurity: P = 120 Torr, $Ar/H_2/CH_4$ = 100/4/1 sccm

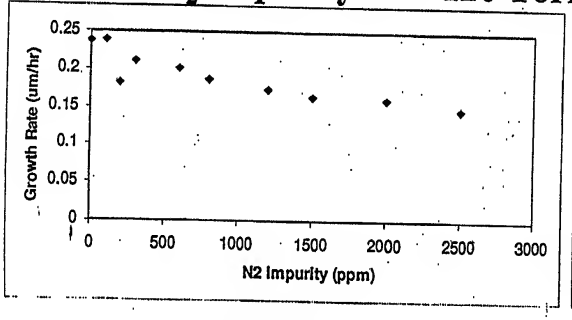

FIGURE 11

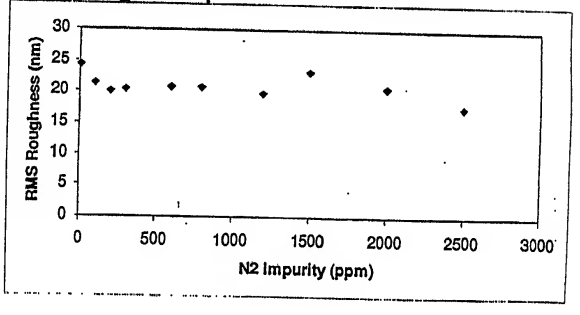

FIGURE 11A

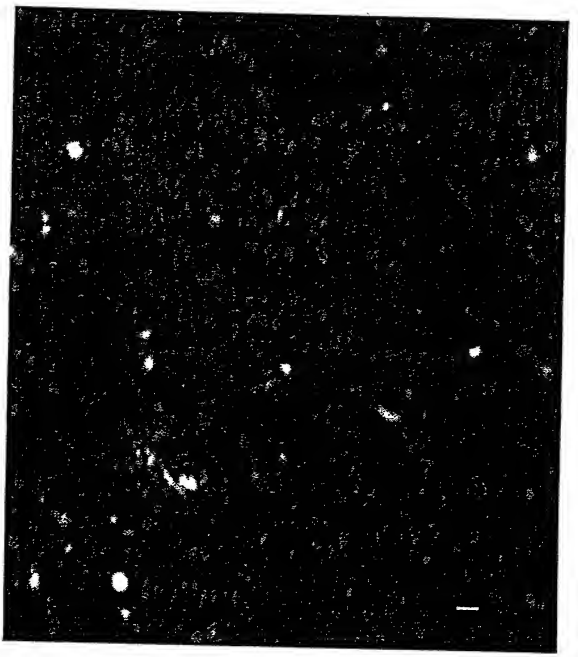

FIGURE 12

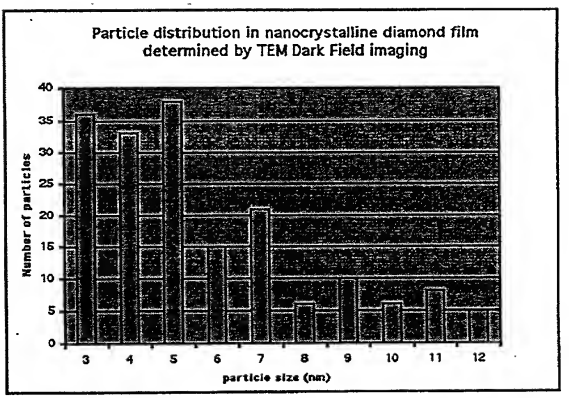
Particle distribution in nanocrystalline diamond film
determined by TEM Dark Field imaging
Number of particles
0
5
10
15
20
25
30
35
40
3
4
5
6
7
8
9
10
11
12
particle size (nm)

FIGURE 13

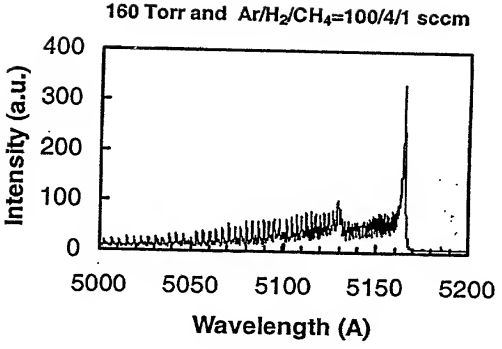

FIGURE 14

C_2 Rotational Temperature

Gas temperature versus pressure.

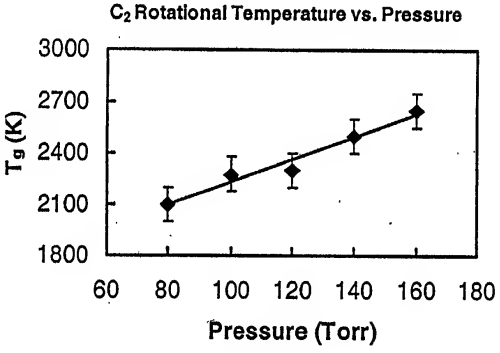

FIGURE 15

Gas temperature versus H_2 Flow.

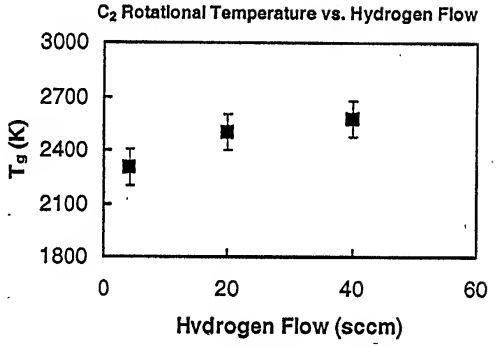

FIGURE 16

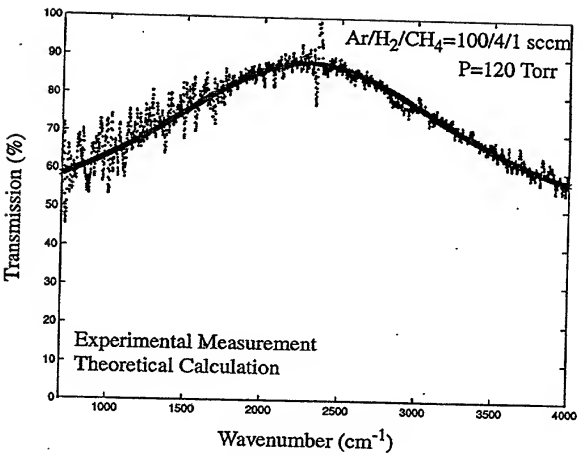

FIGURE 17

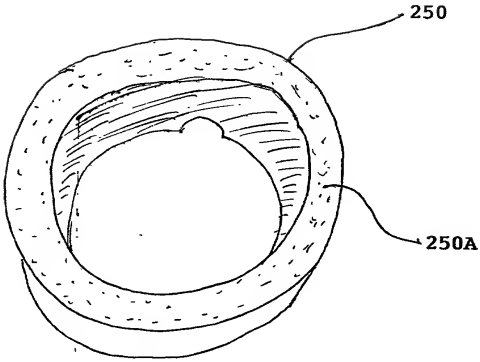

FIGURE 18

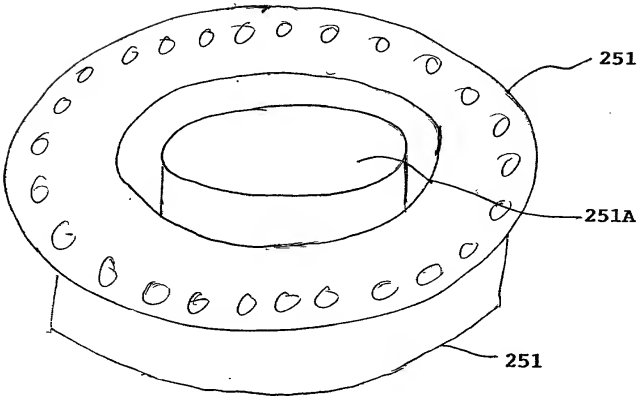

FIGURE 19

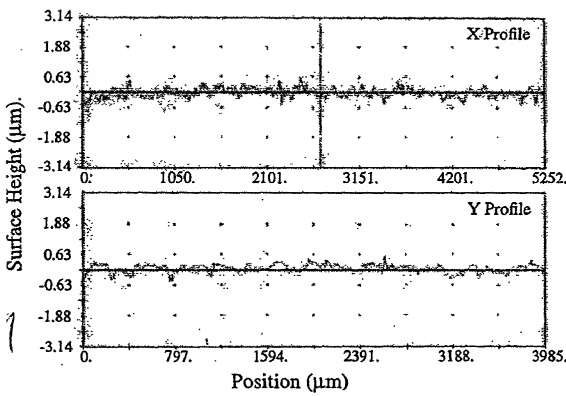

FIG. 20

FIG. 20A